IMPORTANT TO IRON MANUFACTURERS.

DESCRIPTION

OF THE

PATENTED

UNIVERSAL

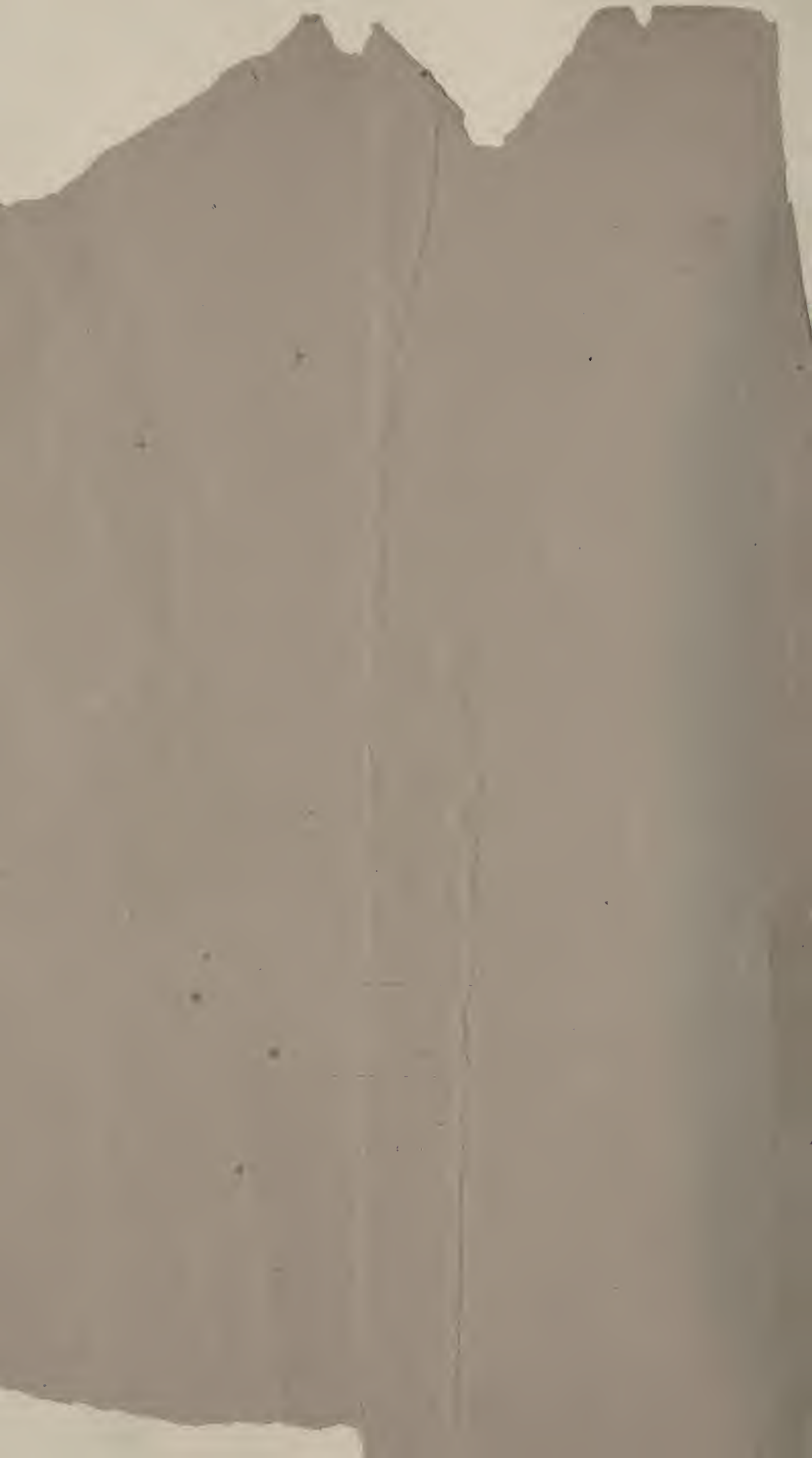
Blast and Smelting Furnace,

INVENTED BY THE RUSSIAN MINING ENGINEER & MAJOR-GENERAL,

WOLDEMAR RACHETTE.

THIS INVENTION IS SUCCESSFULLY INTRODUCED AND PATENTED IN RUSSIA, FRANCE, ENGLAND, BELGIUM, AUSTRIA, SWEDEN, AND WAS AT THE WORLD'S FAIR OF 1862 REWARDED WITH THE PRIZE MEDAL.

New York:
PRINTED BY PHAIR & CO., 11 FRANKFORT STREET.
1864.



DESCRIPTION.

The practical introduction of General Rachette's new system of Blast and Smelting Furnaces has met with great success in Europe. The prominent Iron Manufacturers of Russia, France, and Germany give the most enthusiastic accounts of the results that have been attained in its use.

Careful comparison has elicited the following advantages:

1. A SAVING OF ABOUT ONE-HALF IN MATERIAL AND LABOR, AND OF MORE THAN DOUBLE IN TIME AT THEIR FIRST CONSTRUCTION.

2. A GREATLY INCREASED YIELD, $3\frac{1}{2}$ TIMES GREATER THAN IS OBTAINED FROM FURNACES OF THE OLD CONSTRUCTION OF EQUAL AREA. (See annexed Table.)

3. A SAVING IN FUEL, AVERAGING FROM 9 TO 15 PER CENT.

4. AN EASIER MANAGEMENT OF THE PROCESS, AND A MORE PERFECT REDUCTION OF THE ORES.

5. A BETTER AND MORE UNIFORM QUALITY OF CAST-IRON.

6. A LONGER SMELTING PERIOD AND BETTER PRESERVATION OF THE FURNACES.

These results have been obtained in a number of large furnaces that have been worked during the last two years at the Iron and Copper smelting works of Prince Demidoff, at Nischne Tagilsk, at the foot of the Ural Mountains, in Russia.

These facts have all been verified and confirmed by the results obtained in furnaces erected in France, Germany, and England. Will our American iron-masters follow in the wake of progress?

Prejudices must finally give way to stubborn facts.

This new system of furnaces is no theory or result of small experiments; it is a tested and fully successful invention, which deserves our special attention, and should find a speedy introduction in this country.

Referring the reader to the annexed drawing, I will now proceed to point out the peculiar features by which General Rachette's "UNIVERSAL BLAST AND SMELTING FURNACE" is distinguished from the furnaces of older construction, and such as are now in use:

This furnace is called "Universal" because experience has shown that this system, with but slight modifications, *can, with unerring success, be adopted for smelting of copper, nickel, tin, lead, silver, gold, and other ores or metals.*

CAST-STEEL has successfully been melted in one of these furnaces, and the Russian mining engineer, M. Aubel, states that even PLATINUM has yielded to the intense heat before the mouth of the tuyere.

The hearth has the shape of an elongated rectangle; the interior of the furnace rises up to an inverted square pyramid.

The shape of the furnace, narrow, long, and proportionally low, grows wider at the tunnel head (the top of the furnace); *it is furnished with a double series of tuyeres*, or blast tubes, *arranged in alternate, interchanging order.* This furnace has further *two working sides or tymps, and under its hearth and all through the walls a system of channels and flues,* by means of which the furnace, while being built, is dried and heated from *the outside inside,* and afterwards ventilated, in order to preserve the walls of the furnace from being too much expanded and injured by the accumulating heat.

Some of my readers may desire to understand more fully

the "*reasons why*" a system of such furnaces has produced so extraordinary results : I will therefore append a digest of extracts from several European publications.

A. All furnaces of the old system have boshes and contract toward the tunnel head, and thereby at first hasten, and then retard the descent of the charges, in order to prolong the time of their exposure to the ascending gases. They are therefore built high (50 to 60 feet) to prevent too great loss of heat at the tunnel head, and require a considerable pressure of blast. In the furnaces of old construction the charge remains about 24 hours.

In the Rachette blast furnace, *only* 25 *to* 30 *feet high*, we find no boshes, the inside of the furnace gradually widens from the hearth toward the top, and thereby gives the charges a uniform, regular descent. The pressure of the blast is most materially diminished (from one-half to 3 pounds on the square inch has been found sufficient in most cases), and the intense heat produced at the tuyeres during its passage upwards, over a continually increasing area, becomes more distributed, easier absorbed and tempered. It is very remarkable also, that in these new furnaces the charges *remain only seven hours*, and are nevertheless perfectly reduced and smelted in this short space of time.

B. The use of a larger or smaller number of tuyeres in the old system of round or oval furnaces, and their relative position, have been subject to many discussions, without, however, being decided one way or the other ; all the iron-masters, however, seem to agree in the one point, namely, to place the mouths of the tuyeres toward the center, or opposite each other. In Rachette's furnace the position of the tuyeres, and their arrangement, is peculiar and different from all others. The openings or mouths of the tuyeres are not facing each other, but are arranged in an interchanging order. The most intense heat has been found two inches before the mouth of the tuyere, forming the focus or highest point of heat ; it can, therefore, easily be understood that by this arrangement a series of foci is obtained, one close to the other, forming a perfect uniform melting zone. By this alternate, interchanging blast arrangement a rotary motion is imparted to the unequally

impinged metal, and its liquefaction greatly accelerated. In some of the recently built European furnaces General Rachette has used five or six tuyeres on each side, about one foot distant from the other. In some instances the General has also adopted a system of *slit blast-boxes* in place of tuyeres.

C. The furnaces of older construction, and such as are now in use, are all dried out and heated from the inside to the outside—a very tedious, costly, and time-consuming process, requiring much care and judgment, and consuming, after the furnace is built, a period of nearly a year, and before it is ready for use from 3 to 4 months more.

In the new system of General Rachette's furnaces, the drying and heating as well as ventilating of the walls are accomplished in the *reverse* order, *from the outside to the inside.* The drying of the furnace is carried on while the same is being built, so that the furnace, when completed, can be set to work at once without further delay. Even in winter time and during the wet season, furnaces have been built and successfully dried and heated. For instance, the last furnace erected on this system at Mulheim, Germany, was completed in 4 months, and immediately, without further delay, set to work.

The annexed drawing shows a system of channels and flues, which, beginning under the hearth, branch out in vertical and horizontal directions, through the walls, up to the top of the furnace. Various openings on the sides can be closed or opened at pleasure.

When the smelting process has begun, the circulating atmospheric air carries off the radiating heat from the walls of the furnace, and prevents them from becoming overheated and destroyed by the sudden changes of temperature. By the perfect arrangement of flues, any part of the furnace can be heated up or cooled down. The advantages of this new and important heating and ventilating system may be summed up as follows :

a. Saving of time, labor, and material in the first construction of the furnace.

b. A great economy in fuel in the drying and heating process itself.

c. A most decidedly beneficial ventilating effect.

d. A greater durability and working capacity of the furnace.

TN713
.F6

c. It prevents many difficulties and mishaps occurring frequently in furnaces of old construction, such as chilling or clogging up, and facilitates the process and working most effectually.

D. The Rachette furnace has two tymps or working sides. The greater yield of metal, and the rapid passage of the charges through the furnace, make an increase of space for tapping, casting, etc., necessary, and facilitate the working.

E. The charges in this furnace are made in the same way as in the furnaces of old construction, with this difference, that the ore and flux are placed more around the outer edges of the tunnel head, while the coal is placed more toward the middle. Experience has shown that, by this mode of charging, whereby the ore and flux are brought nearer to the mouth of the tuyeres, leaving the fuel more toward the center, a decided saving in fuel, as well as also a more complete reduction of the ores, are obtained.

F. The rapid yield and excellent quality of metal produced in the blast furnaces recommend the adaptation of this system for *Cupola* and *Refining* furnaces.

M. Charles Aubel, the constructor of the furnaces in Europe, states that the production of large masses of CAST-STEEL has been successfully accomplished, either from cast-iron alone, or from a mixture of the proper materials.

This system of furnaces is admirably adapted for EXTRACTING THE IRON FROM THE WASTE CINDER OF PUDDLING AND REHEATING FURNACES after having been prepared by my patented process. Discussions of a more elaborate nature can be found in the London Mining and Smelting Magazine for April and May, 1864, Dinglers Polytechnisches Journal, Berg and Hüttenmännische Zeitung, Pamphlets written by Charles Aubel, C. E., in St. Petersburg, Russia, and Professor Schinz, in Strasbourg.

A. L. FLEURY,

Practical Chemist.

NEW YORK, August, 1864.
74 University Place.

PRACTICAL RESULTS.

The following results have been published in the London Mining and Smelting Magazine for July, 1864 :—During the first four weeks of working of the Rachette furnace at Mulheim in Germany, the total make of the furnace amounted to about 800,000 lbs. (400 tuns) of gray pig-iron, the quality of which, as foundry metal, left nothing to be desired. The make of the first day amounted to 9,900 lbs. ; that of the fourteenth day to 39,200 lbs. ; that of the twenty-second to 42,300 lbs. ; and that of the twenty-fifth to 45,600 lbs. Subsequently, in consequence of the use of poorer ores being adopted, the make dropped back on the thirtieth day to 42,300 lbs. . The credit is mainly due, in this instance, to the constructor of the furnace, Mr. Charles Aubel, who has after three months' working guaranteed a daily make of from 36,000 to 40,000 lbs. of gray pig-iron, a make which, as has been shown by the figures above given, had been obtained in the third week of working. With respect to the saving of fuel in this furnace, the furnace is not yet in its full working condition, and also the ores used were such as required 50 to 55 lbs. of limestone flux per 100 lbs. of ore.

Taking the circumstances stated into consideration, the consumption of fuel, which amounted to 1,500 lbs. of Westphalia coke per 1,000 lbs. of gray pig-iron made, cannot be considered as unsatisfactory. The pressure of blast was very low, from $1\frac{1}{4}$ to $1\frac{1}{2}$ lbs., while the furnaces of the ordinary form require at least double that pressure. Hence at the new Mulheim furnace half the fuel formerly required for generating steam for the blast engines is now saved.

It must be remembered that the capacity of this furnace, costing not more than 10,000 dollars, is only about 2,800 cubic feet.

Name of the Iron Works or of the Furnace.	Description of the Furnace.			Quantity of Ores Smelted in 24 Hours. cwts.	Nature of the Ores.	Per-centage.	Consumption of Fuel in 24 hours.			Make of Grey Pig per 24 hours. cwts.	Consumption of Fuel per 1 cwt. of Pig-Iron.		
	Capacity of the Furnace in cubic ft.	Hight in feet.	No. of the Twyers.				Coal in cwts.	Coke in cwts.	Charcoal, cubic ft.		Coal, cubic ft.	Coke. cubic ft.	Charcoal, cubic ft.
Werchne Lalda. Blast-furnace on the Rachette principle. First furnace for experiments, only with one tymp.	2180	30·9	6	Greatest make 959·71 Average make of 9 months 805·23	Magnetites	69	—	—	5493·6	660·4	—	—	9·145
						67·8	—	—	4875·6	511·5	—	—	10 486
Werchne Lalda. Blast-furnace on the Rachette principle. Second furnace for experiments, only with one tymp.	3052	41·2	8	Greatest make 936·7 Average make of 6 months 900·63	Magnetftes	69·2	—	—	5493·6	648·5	—	—	9·265
						67·2	—	—	5455·5	578·8	—	—	10·355
Nischne Tagilsk. Blast-furnace on the Rachette principle.	2125·5	22·66	12	Greatest make 882·61 Average make of 8 months 792·0	Magnetites	67	—	—	5569·9	604·8	—	—	10 355
						68	—	—	5341	550·0	—	—	10·682
Nischne Tagilsk. Blast-furnace of the old round form.	5907·8	51·5	2	666·4	Magnetites	67·5	—	—	4578	449·6	—	—	11·118
Altenau, in the Harz.	1090	28·84	1	944·1	Hematites, Magnetites, and earthy brown iron ore.	37·25	—	—	915·6	55	—	—	18·53 =105 lbs
Blast-furnace at Blaenavon.	3878·22	—	3	904·37	—	37·04	—	653·2	—	335·0	—	2·125	—
New blast-furnaces in Staffordshire.	4583·45	—	5·7	1004·9	—	44·4	1340	—	—	446·6	3·27	—	—

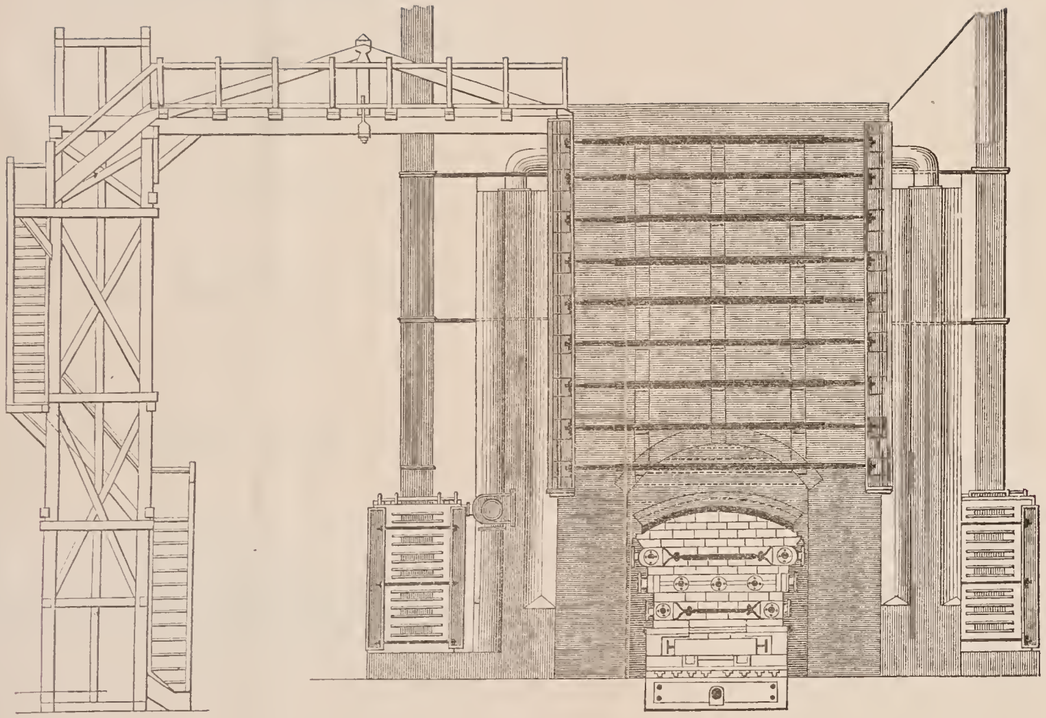


FIG. 1.

Universal Blast and Smelting Furnace,

Invented by the Russian Mining Engineer and Major-General,

WOLDEMAR RACHETTE.

PATENTED IN THE UNITED STATES, RUSSIA, FRANCE, ENGLAND, BELGIUM, AUSTRIA, SWEDEN, etc.

The present sketch is taken from the Working Drawings of the last built successful Furnace, at Mulheim, Germany.

Fig. 1 represents a Front View.

" 2 a Vertical Section.

" 3 a Longitudinal Section.

" 4 a Horizontal Section of the Hearth.

" 5 a Horizontal Section of the Heating Arrangements.

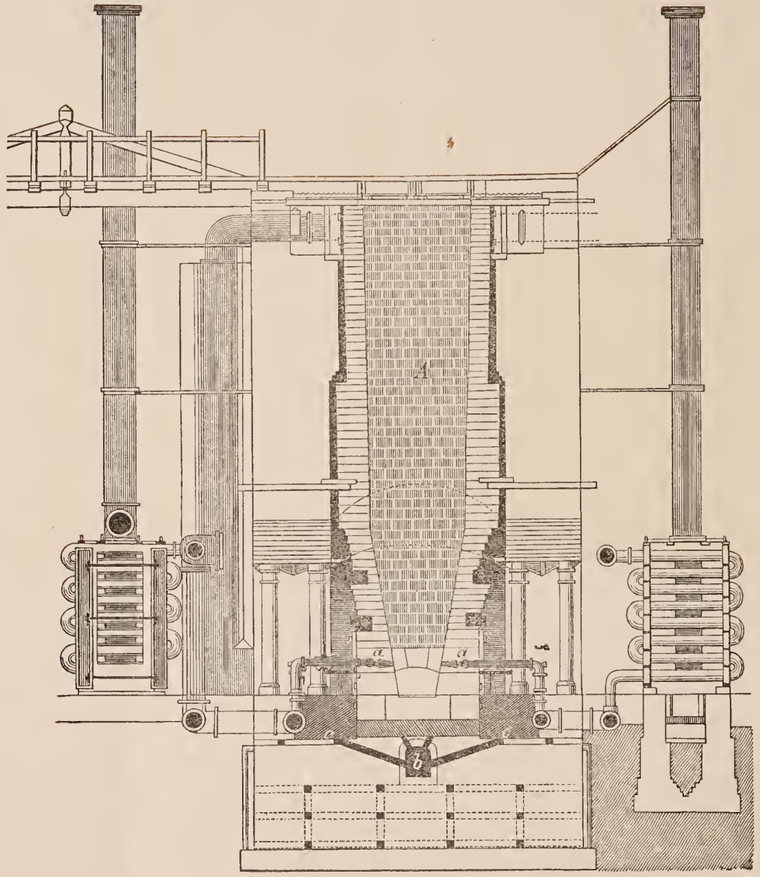


FIG. 2.

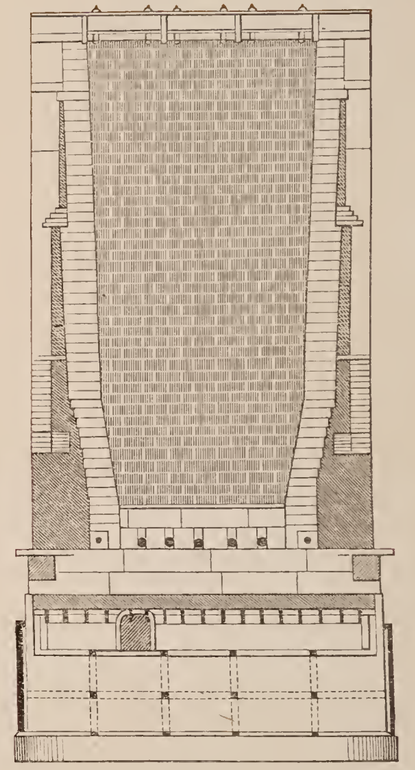


FIG. 3.

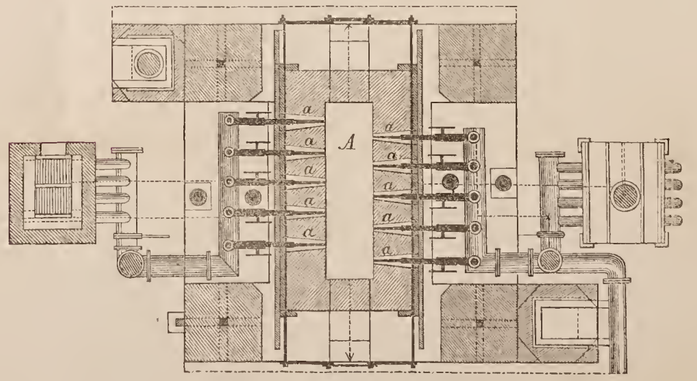


FIG. 4.

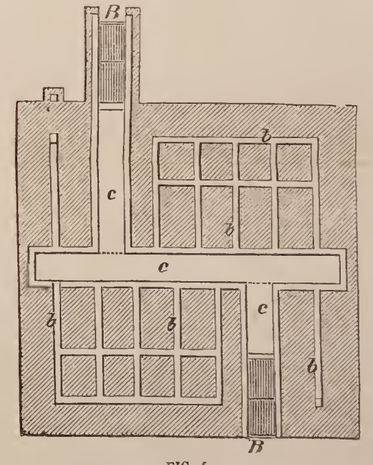


FIG. 5.

IMPORTANT TO IRON MANUFACTURERS.

DESCRIPTION

OF THE

PATENTED

UNIVERSAL

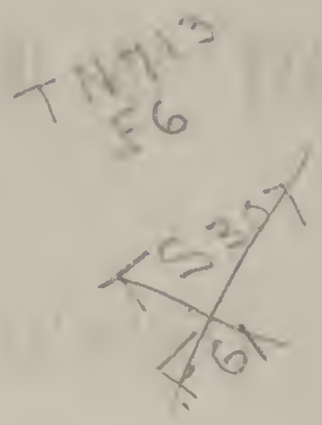
Blast and Smelting Furnace,

INVENTED BY THE RUSSIAN MINING ENGINEER & MAJOR-GENERAL,

WOLDEMAR RACHETTE.

THIS INVENTION IS SUCCESSFULLY INTRODUCED AND PATENTED IN RUSSIA, FRANCE, ENGLAND, BELGIUM, AUSTRIA, SWEDEN, AND WAS AT THE WORLD'S FAIR OF 1862 REWARDED WITH THE PRIZE MEDAL.

New York:
PRINTED BY PHAIR & CO., 11 FRANKFORT STREET.
1864.


T N 7 S
R 6
S 33
6